

Georgia Southern University Digital Commons@Georgia Southern

Electrical & Computer Engineering News

Electrical & Computer Engineering Publications

5-10-2018

Electrical & Computer Engineering News

Georgia Southern University

Follow this and additional works at: <https://digitalcommons.georgiasouthern.edu/electrical-eng-news-online>



Part of the [Electrical and Computer Engineering Commons](#)

Recommended Citation

Georgia Southern University, "Electrical & Computer Engineering News" (2018). *Electrical & Computer Engineering News*. 23.
<https://digitalcommons.georgiasouthern.edu/electrical-eng-news-online/23>

This newsletter is brought to you for free and open access by the Electrical & Computer Engineering Publications at Digital Commons@Georgia Southern. It has been accepted for inclusion in Electrical & Computer Engineering News by an authorized administrator of Digital Commons@Georgia Southern. For more information, please contact digitalcommons@georgiasouthern.edu.

Data-driven Adaptive Optimal Control and Its Applications

May 10, 2018

Abstract: In many industrial applications, constructing an accurate model from physical laws is a hard and time-consuming undertaking, which makes traditional model-based control approaches impractical. With the recent advance of information science and technologies, scientists and engineers are actively seeking efficient ways to develop data-driven intelligent control systems that are highly robust, adaptive, scalable to uncertain or unknown environments. Adaptive dynamic programming (ADP) is a practically sound data-driven, non-model-based approach for control design in complex systems. In this talk, I will introduce a novel framework of adaptive optimal control by ADP. This framework can be employed to address different control problems, including output regulation, cooperative control and output-feedback control of linear and nonlinear dynamical systems. I will also present its applications to intelligent transportation systems, especially connected vehicles and autonomous vehicles. The future research challenges and opportunities in this area will be discussed as well.



Posted in [Faculty Research](#), [News](#), [Research](#)

Delivering Ultra-Reliable, Low-Latency Communications, by Dr. Omid Semiari

May 10, 2018

Millimeter-Wave-Sub-6 GHz
Wireless Networks

Omid Semiari

Department of Electrical and Computer Engineering, Georgia Southern University

Abstract– Emerging wireless services such as augmented reality require next-generation wireless networks to support ultra-reliable and low-latency communication (URLLC), while also guaranteeing high data rates. Existing wireless networks that solely rely on the scarce sub-6 GHz, microwave (μW) frequency bands will be unable to meet the low-latency, high capacity requirements of future wireless services due to spectrum scarcity. Meanwhile, operating at high-frequency millimeter wave (mmWave) bands are seen as an attractive solution, primarily due to the bandwidth availability and possibility of large-scale multi-antenna communication. However, even though leveraging the large bandwidth at mmWave frequencies can potentially boost the wireless capacity and reduce the transmission delay for low-latency applications, mmWave communication is inherently unreliable due to its susceptibility to blockage, high path loss, and channel uncertainty. Hence, to provide URLLC and high-speed wireless access, it is desirable to seamlessly integrate the reliability of μW networks with the high capacity of mmWave networks. In this talk, we will first provide an overview on fifth-generation (5G) wireless networks, service requirements, and main challenges. Second, we introduce the vision of integrated mmWave sub-6 GHz communications as a key enabler to achieve URLLC along with high data rates by leveraging the best of two worlds: reliable, long-range communications at the μW bands and directional high-speed communications at the mmWave frequencies. Within this integrated networking paradigm, we present our key solution concepts that include new architectures for the radio interface, resource allocation methods, along with mobility management. Finally, we present preliminary results of our future research directions.



Omid Semiari is an Assistant Professor at the Electrical and Computer Engineering Department at Georgia Southern University. He received the BSc and MSc degrees in electrical engineering from the University of Tehran, in 2010 and 2012, respectively, and the PhD degree from Virginia Tech, in 2017. His research interests include wireless networks, millimeter wave communications, context-aware resource allocation, matching theory, machine learning, and signal processing. In 2014, Dr. Semiari has worked as an intern at Bell Labs, in Stuttgart, on anticipatory, context-aware resource management in cellular networks. In 2016, he has joined Qualcomm CDMA Technologies (QCT) for a summer internship, working on LTE-Advanced modem design. Dr. Semiari is the recipient of several research fellowship awards, including DAAD (German Academic Exchange Service) scholarship and NSF student travel grant. He has actively served as a reviewer for flagship IEEE Transactions and conferences and participated as the technical program committee (TPC) member for a variety of workshops at IEEE conferences, such as ICC and GLOBECOM. Currently, he serves as a member of editorial board for the IEEE ComSoc TCBNC blog and IEEE ComSoc TCCN Newsletter.

“Human RF Exposure to Cellular Communication Networks, BY Dr. Kim”

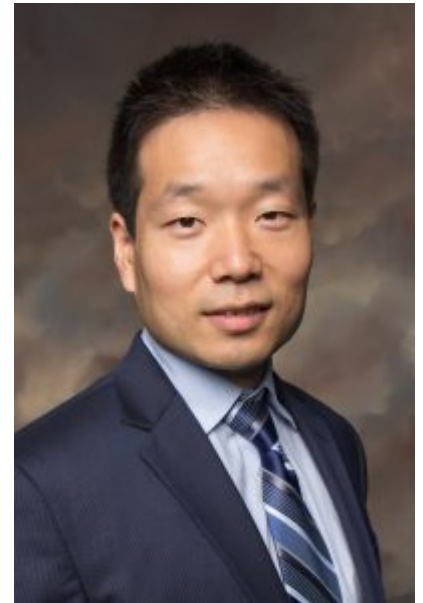
May 10, 2018

Electrical Engineering Research Colloquium

3PM Friday December 1st

IT 1206

Seungmo Kim and Imtiaz Nasim



Human RF Exposure in Cellular Communications Networks

Concern has been widely acknowledged about human health—e.g., heating of the eyes and skin—from exposure to RF fields produced by wireless transmitters. Mobile telecommunications rely on an extensive network of base stations (BSs) and handheld devices that transmit signals via RF fields.

There is a chance of aggravation due to two important changes that will be seen in future cellular networks. First, the number of BSs will remarkably grow with the proliferation of small-cell networks, which will expose humans to RF fields more often. Second, highly concentrated RF beams will be generated by employing larger antenna arrays to overcome faster RF energy attenuation in higher-frequency bands such as millimeter wave (mmW) spectrum, which will increase damage if the main beam points at a human body. Our research is on the design of a mmW cellular network that keeps users safe from RF exposure. Specifically, it aims to harness the aforementioned two changes as the leverages for (i) wider selection of alternative BSs and (ii) more precise beamforming to the desired user equipment (UE) with less RF leakage to other directions, respectively.

Operation of Future Cellular Networks in Shared Bands

To meet the recent burgeoning demand for bandwidth, the US government has been putting comprehensive effort into realization of spectrum sharing. Another explicit direction of the US government's movement is to open millimeter wave (mmW) spectrum bands above 24 gigahertz (GHz), owing to recent technological breakthroughs that have newly enabled advanced mobile services in such high bands.

This research is motivated by three technical challenges inherent in the current status of literature in spectrum sharing. Firstly, spectrum sharing is scenario-specific. Accordingly, a spectrum sharing method must be band-specific, since, in different shared bands, different sets of primary and secondary systems are to operate. Secondly, additional control signaling overhead is necessary for coordination of multiple wireless systems in a single band. Due to the dissimilarity of wireless systems and the larger numbers of transmitters, the complexity of a communications and networking protocol will be far higher compared to that of a current wireless system. Thirdly, a UE that is held in hands of a user often presents a limited antenna gain due to the spatial limit to integrate a high-dimensional antenna. This will lead to the limited capability of a UE in communicating with an appropriate base station (BS), and eventually inefficiency in spectrum sharing.

**Traffic Safety Improvement via
Integration of V2X Communications and Driver Eye Movement Tracking**

Vehicle-to-everything (V2X) communications have been taking a critical role in facilitating safety applications in intelligent transportation systems (ITS). However, both of the two representative technologies—Dedicated Short-Range Communications (DSRC) and cellular V2X (C-V2X)—have been showing limitations: (i) contention for bandwidth and (ii) latency. Such limitations are expected to cause breakdown of V2X communications in scenarios such as very high traffic density, which this project refers to as “safety hole.” Driver eye movement tracking (EMT) has also been attracting interest in ITS as driver vision is one dominating factor in safe driving. Yet the main drawback of this technology is exceeding electrical energy consumption which limits its applicability in the directions of automotive industry evolution such as electrical vehicles and autonomous vehicles where efficient use of electrical energy becomes essential. This project aims to design a comprehensive traffic safety system via integration of V2X communications and driver EMT as a solution for each other’s problems. Driver EMT aids V2X communications to reduce (i) the frequency of safety hole occurrences and (ii) the length of a safety hole in V2X communications; while V2X communications make driver EMT require minimized electrical energy. This research plan suggests achieving three specific objectives. First, a mathematical analysis framework for V2X communications will be established. Then, the performance improvement via application of data aggregation and spectrum sharing, the key solution techniques that this research suggests for resolving the aforementioned limitations of V2X communications will be modeled. Second, driver EMT data will be studied for devising an EMT mechanism that is optimized for data aggregation and spectrum sharing. Statistical analyses will be conducted to find a pattern on contribution to accident events via comparison of data sets in various settings and scenarios. Third, an integrated traffic safety platform simulation software will be created. This simulator is to evaluate the performance of the proposed comprehensive traffic system that performs the core components—V2X communications (operating spectrum sharing and data aggregation) and driver EMT.

Posted in [Faculty Research](#), [News](#), [Research](#)